

EYESIGHT and SCHOOL LIFE

SIMEON SNELL, F.R.C.S., Ed.

UNIVERSITY OF BRISTOL.

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AND

SCHOOL LIFE

BY

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TO
MY WIFE.

PREFACE.

THIS little volume originated in a lecture delivered some time since before an Elementary Teachers' Association, and subsequently repeated before a branch of the Teachers' Guild. In its more extended form, as here presented, it will, it is hoped, awaken some interest, and not be without value to those who are already alive to the importance of the subject. Technicalities have as far as possible been avoided, and in the case of those employed, foot notes have been inserted to render the meaning clear to non-medical readers.

My thanks are due to Mr. Bellamy, a student of the Sheffield School of Medicine, for the kind manner in which he has on this and many other occasions, placed his skill as a photographer at my disposal. Without his valuable assistance it

would hardly have been possible to have illustrated this little work in the way it has been done.

I am indebted to Mr. John Jackson, and his publishers, Messrs. Sampson Low & Co., for granting me the loan of two electrotypes, to illustrate points respecting Vertical Writing.

SIMEON SNELL.

SHEFFIELD,

June, 1895.

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EYESIGHT AND SCHOOL LIFE.

THE importance of this subject is much more generally recognised now than was the case a few years ago. The efforts of those who have toiled to bring it home to the parents and teachers of the children of this and other countries have without doubt met with a good deal of success. No medical man seeing much of eye affections in children can, however, shut his own eyes to the fact that there is still room for a much more widely extended knowledge.

The educational period embraces that in which growth and development are the most active. Health has been well termed the greatest of blessings, and fortunately considerable attention has been given of recent years to physical exercises in schools. The advantages of a cultured mind will seldom recompense for an enfeebled physique, nor will the highest educational success be without alloy if in its attainment the functions of sight have become deteriorated. Day by day it becomes more evident that good vision in all walks of life is no luxury, but a

necessity, and many of the avenues to employment are being closed to those who possess impaired eyesight.

There is, it appears to me, abundant and convincing evidence that the vision of children, which should apparently, under normal conditions, have remained good, is constantly deteriorating during the school period. The much larger number of children who are put into spectacles to-day than was formerly the case, is, no doubt, an evidence of our expanded knowledge, but shows also a real increase in the number of those requiring optical aid. The truth is, the eye is unequal to the task which is too often expected of it. It is an ascertained fact that nearly all children at birth are hypermetropic, or long-sighted, and that in the course of growth and development, these same eyes become emmetropic, or in other words, have the normal refraction. The time was when vision for distance was almost the only sight required, that for near objects being only occasional. The savage is found in this state at the present time, and his keen vision for objects at, to us, almost surprising distances, is well known. Civilisation, bringing in its train the printing press with its huge outpour, has changed the face of things. The hours that even little children spend over work close to their eyes, including fine sewing, is almost perhaps bringing

us to even the opposite extreme, viz., that the use of vision for near objects is becoming constant, and that for distant occasional. The two means by which the eye accomplishes this close work are nearly allied, and both are muscular. When focusing is undertaken for a near object convergence also goes with it. It is important to bear in mind that this act of accommodating is a muscular one, and with undue work fatigue will ensue just in the same way as weariness and disability will result from an over-exerted muscle in arm or leg.* Eye-strain from this cause is a

* The terms *Accommodation* and *Convergence*, may be thus explained. (a,) If we look at a distant object and then to a book at about ten inches, to see the latter clearly the eye has to *accommodate*, or, in other words, alter the convexity of the lens, a process which is brought about by means of the ciliary muscle situated behind the pupil and external to the lens. Atropine has the power of temporarily paralysing this muscle, and therefore the power of *accommodating*. If this drug be dropped into a normal eye, distant vision will not be interfered with, but near vision will be rendered blurred and indistinct. Place, however, a convex glass of 10 (+4D) inches focus before the eye, and reading will be accomplished with facility; the strength of this glass represents the degree of increased convexity of the crystalline lens brought about by accommodating for a near object. A drug such as Atropine is called a mydriatic, and its use when ascertaining the correct glasses in certain cases is often desirable. (b,) Together with the act of *accommodation* when the eyes are directed to a near object, they are also turned inwards by means of the inner straight muscle of either eye; in other words, the eyes *converge*.

This explanation will make clear the meaning in the text that both accommodating and convergence are *associated actions*, and also *muscular ones*.

frequent source of discomfort to children at school, and it sows the seed of future defective vision in many instances.

Broadly speaking, what we have to consider are the relations of hypermetropia, or long sight, and myopia, or short sight, to the school life of children. Astigmatism* is of the highest importance even in low degrees, but for our purposes it will be better to confine attention to the two broad divisions into which refraction errors are placed. Astigmatism, whether simple, compound, or mixed, falls towards one or the other of these groups, and it is essential that its possible existence should be borne in mind, however low the degree, when testing for and prescribing glasses for scholars.

In the normal or emmetropic eye parallel rays of light are brought to a point on the retina (*Fig. 1*).

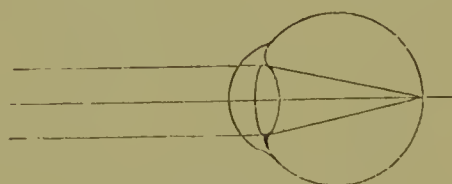


FIG. 1.

In hypermetropia, however, the refractive power is too low—the eye is, in fact, too short from before

* Astigmatism is that condition in which the curvature of one meridian of the eye (cornea), is different from another. A bowl of a spoon, with its long and short radius of curvature will represent the idea wished to be conveyed. It will be understood that as a consequence the focus (refraction) of the different meridians is unequal.

backwards, and rays issuing from a distant object do not come to a focus on the retina but beyond

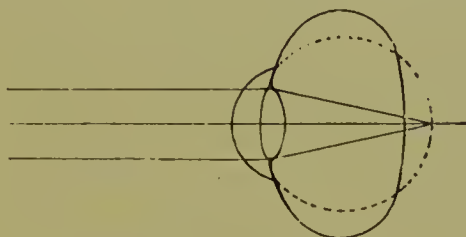


FIG. 2.

it (*Fig. 2*). Myopia is the exact converse of this ; the refractive power is too high—the eye is too long from before backwards, and the rays of light are brought to a focus in front, instead of on the retina (*Fig. 3*). The first condition is corrected

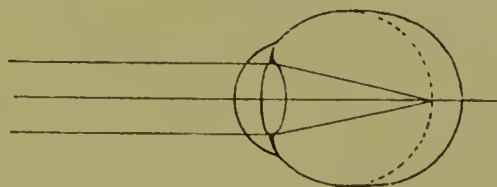


FIG. 3.

by a convex and the second by a concave glass.

The normal or ideal eye is curiously of less frequent occurrence than is popularly supposed. The refraction in new-born babes, as shown by the observations of Ely, Horstmann, and others, is generally hypermetropic. As a result of growth and development this condition alters and passes gradually into the emmetropic or normal state of refraction. This is certainly true of the lower degrees, but is less so perhaps of the high ones. Less frequently the hypermetropic eye passes into a condition of myopia.

In the hypermetropic eye, parallel rays of light are brought to a focus not on the retina, but behind it (*Fig. 2*). The eye naturally seeks after clear, distinct images, and in the normal eye this is attained by the action of the ciliary muscle increasing the convexity of the lens. But the eye under consideration being under-focused, to bring the image to a point on the retina, extra effort is called for, and this being, as has been mentioned, a muscular action, discomfort and disability are liable to follow over-use, and, moreover, frequently occur, as evidenced by fatigue of and pain in the eyes and a running together of the print. Nor is this only observed in association with high degrees of the defect, but on the contrary it is by no means infrequent to find great distress occasioned by low grades.

Many of these eyes moderately used, even with a fair amount of hypermetropia, will get along with little or no discomfort. They will merely require glasses earlier than would otherwise have been the case. But given an amount of close work, such as reading, writing, or sewing, especially if the nervous system is otherwise overdone, and the train of distressful symptoms will be set going. A cause of the headache so often complained of by children is frequently to be found in the conditions just mentioned.

Another point to be noted here bears upon this

question of strain. The ciliary muscle after producing the alteration of focus necessary for close work should, the occasion for its use having ceased, relax, and pass into a state of rest. Not so always, however, with these hypermetropic eyes, for by no means uncommonly a kind of spasm or cramp results, and a fictitious near-sightedness is induced, and there is little doubt that many eyes neglected at this stage become almost imperceptibly myopic in reality.

The treatment, years ago, for eyes in the state that has just been described, was rest. In those days absence from school or the relinquishing of the hopes of a career in which vision would be of consequence, were small matters. Our knowledge has increased and education has become a necessity even to the child of humblest parents, and it is our endeavour, on the lines regulating school work, to be presently referred to, to lessen the causes which bring about discomfort. Attention must be given to the refraction, and it is desirable in all cases to estimate this under the influence of a mydriatic.* Not only will our testing by this means be done more correctly, but the rest induced thereby in the ciliary muscle will be distinctly beneficial. It is beyond the scope of this little work to enter upon the question of the

* *Vide* footnote on Accommodation and Convergence, page 3.

proper selection of spectacles, and all that is necessary is to allude to the importance that astigmatism, even of low degree, inequality of the two eyes, and disorders of muscle balance, bear to the relief of eye symptoms and headache.

It is, however, to Myopia, or Near-sightedness, that most of our remarks will be directed. It is the more serious condition as far as vision is concerned. It has been described as the "melancholy privilege of the professions," and "an accompaniment of intellectual progress." It is, at any rate, a direct result to a great extent of our civilisation. Myopia is that condition of the eye in which the rays of light, in consequence of the too great length of the globe from before backwards, are not brought to a focus on the retina, but in front of it (*Fig. 3*). Hypermetropia has been spoken of as congenital. Myopia is seldom so. It is sometimes present in very early life, but it usually makes its appearance about the eighth year. For our purpose it may be regarded as acquired, and the number of myopes is being constantly recruited by others, which have passed over into this group from the hypermetropes. Several cases have been noted whilst under observation.

Myopia is seldom found in new-born infants. As has been stated, the exact opposite is the case. The fact that among savage races myopia is

absent has often been quoted, and the keen vision possessed by these people is well known. Not long since it was also reported from Mexico that among the natives there was a complete immunity from the affection ; among the half breeds it was occasionally met with, but among the Europeans much more frequently. Among civilised people generally, the frequency and also the degree of the defect correspond to the demands made on the eye.

There is, in my opinion, no doubt that during school life eyes which previously gave no indication of such a condition have become near sighted. Further than this it is beyond question that during the scholastic period, the degree of myopia frequently becomes aggravated. The long continuance of close work with imperfect light, a stooping posture, and with perhaps the brain and body fatigued, are among the causes which lead to this end. It must further be remembered that the extra focusing of the eyes, and the continued convergence necessary for this close work, not only aid in bringing about myopia or increasing it when present, but that the progress of the short-sightedness demands itself still further convergence, and therefore the condition once present reacts upon itself.

It is necessary to combat the too popular impression that to have myopia is rather a bless-

ing than otherwise. This belief is perhaps greatly due to the fact that those possessing very weak and stationary degrees of myopia are often afforded thereby a longer period without the requirement of glasses for reading than their emmetropic fellows.

There is a good deal to be said for regarding the myopic as a pathological eye. Donders held this view, and Dr. Risley, of Philadelphia, is especially strong in the same opinion. Mr. Priestley Smith expresses himself in these words—"Myopia is always a defect ; often a disease. It is entirely incurable, but largely preventable. Its progress can be, and often is, accelerated by improper use of the eyes, and retarded by judicious interference."

It must be borne in mind that progressive myopia is very often associated with organic disease. The choroid is specially prone to be affected, and the region of the yellow spot often suffers. As the axis of the eye extends backwards the choroid becomes atrophied, and shows itself as a "crescent" at the side of the optic disc. Among other conditions may be mentioned disturbances of the vitreous and detached retina.

There are various causes, in addition to what will be said about the conditions of school life, which appear to predispose to the development of myopia. Heredity is one of these ; the forma-

tion of the orbits ; a difference between the eye centres and a condition inherent, no doubt in the structure of the eye itself, which more readily allows of a yielding of the tunics and the prolongation of the axis backwards, must also be mentioned.

The relation of myopia to school life and work has been closely studied by many observers. It will not be necessary to refer at any great length to the very extensive statistics on the subject. It has, however, been established that children entering school with healthy eyes have become short-sighted, and that the proportionate number of the scholars affected increases as we ascend in the classes and also in the grade of school. Figures bearing on these points were published not long ago. In Munich in 1889 there were 2,327 children suffering from defective sight ; 996 boys and 1,331 girls. A gradual increase in the figures was observed, according to the distribution of the pupils into the several classes. Thus of every 1,000 boys in the first or elementary class 36 were short-sighted ; in the second, 49 ; in the third, 70 ; in the fourth, 94 ; in the fifth, 108 ; in the sixth, 104 ; and in the seventh or last, 108. The number of short-sighted boys, therefore, from the first class to the seventh increased about seven-fold. In the case of the girls the numbers went up from 37 to 119.

Cohn, of Breslau, who was not only one of the first, but has been one of the chief workers on this subject, says, "The frequency of myopia is shown by the following statistics. I noted in five village schools, 1·4 per cent. myopia; in twenty elementary schools, 6·7 per cent.; in two higher schools for girls, 7·7 per cent.; in two middle schools, 10·3 per cent.; in two real schools, 19·7 per cent.; and in two gymnasia schools, 26·2 per cent.; that is, out of 10,060 children, 1,004 were myopic, or 9·9 per cent."

From this he points out that in village schools the percentage of myopia is very low, while in the town schools the number of short-sighted scholars constantly increases with the grade of the school from the lowest to the highest. Moreover, in every school the number of short-sighted children goes up from class to class. In the gymnasia, from the sixth to the first the percentages were 12·5; 18·2; 23·7; 31; 41·3; 55·8.

Cohn carried his observations even further than this, for after an interval of a few terms he re-examined the same children who had previously been noted by him. The interval was eighteen months, and at the Friedrich Gymnasium in Breslau, he found 138 pupils still there whom he had previously examined. Eighty-four of these were at his former visit normal—70 now remained so; 14 had become myopic. Of the 54 pre-

viously found to be myopic 28 had developed a decidedly higher degree of short sight in the year and a half. He noticed also, what is of the utmost importance, that an actual lowering of visual power had also resulted in these myopic eyes, and that a development of changes in the fundus of the eye had taken place in the three half-years, viz. in 10 per cent.

Cohn's observations have received corroboration from workers in this field of hygiene in all countries. In this country, Ware, as long ago as 1812, was alive to the effects of studious habits on eyesight, and whilst among 1,300 children whom he examined at the Chelsea Military School he found only three inconvenienced by short-sightedness, at the Colleges of Oxford and Cambridge he found it very prevalent. The records of this old worthy possess perhaps more classical interest than actual value now, and cannot be compared with the careful and elaborate observations which are so abundant on this subject at the present time.

Erismann in researches at St Petersburg showed that the percentages of myopia increased with the lengthening of hours of study. He examined 4,358 pupils, and among those working two hours a day, he found a percentage of 17·7 myopic; those working four hours 29 per cent., and those studying six hours a day 40 per cent. The pupils were, it should be mentioned, Germans,

In this connection the observations of Seggel and Tscherning are of interest.

The former examined 1,600 soldiers of the Munich Garrison. According as their occupation required more or less close work he divided them into five classes. The first included country folks ; the second those employed in open-air avocations in towns, such as day labourers, etc. ; the third, handicraftsmen and artisans ; the fourth, tradesmen, merchants, writers, printers, etc. ; the fifth those who offered themselves as one year volunteers—these were chiefly students. Myopia in these classes was found rising from the lowest to the highest, 2, 4, 9, 44, and 58 per cent.

Tscherning's investigations included 7,523 persons liable to military service, who were similarly arranged in six classes. Myopia was found to increase in the following ratio, 2, 5, 12, 13, 16, and 32 per cent. (Fuchs).

Myopia is found to be much more prevalent in some countries than in others, and, without doubt, race enters somewhat into the question. Germany and Russia head the list. France is the fifth on the list. At present our own country fares much better than others. Dr. Loring found at New York among children working under the same number of hours, and under similar conditions in other respects : Germans, 23·23 per cent. ; Americans, 19·35 per cent. ; Irish, 14·28 per cent. Mr.

Priestley Smith, who has done excellent work on this subject, examined at Birmingham about 1600 children at the Board Schools, and 350 at a Teachers' Training College; among the former there were 5 per cent. and among the latter 20 per cent. short sighted. It has been suggested that the broad, low face of the German contains the conditions for the production of myopia, while the long, narrow face of the English or American disposes towards hypermetropia. Landolt has referred to this influence of the race, and he says "It is evident that myopia will be developed more rapidly in eyes that are already relatively long, *i.e.*, emmetropes and slight myopes, such as we find with a development of skull in the antero-posterior diameter; thus race becomes a probable factor in the causation of myopia."

Many observations have been made in America, and a brief reference must be made here to the results. Risley found 19 per cent. of myopia among the pupils of the normal schools of Philadelphia; and Randall, in an examination of the eyes of over three thousand scholars in the schools of Philadelphia, found an average of over 11 per cent. of myopia. Wallace examined under atropine 2582 eyes at Philadelphia University Hospital, and found that 287, or 11 per cent., had myopia or myopic astigmatism;

the remainder were hypermetropic. Derby, among the students of Amhurst College, found 28 per cent. near-sighted. At Harvard College also 29 per cent. were short-sighted, and a further examination of the same students by the same investigator a year afterwards showed that half the near-sighted students had reached a higher degree of the defect. After the lapse of four years Derby repeated his examination and found that 10 per cent. of those who at the first examination showed normal vision, had by this time changed to myopes, and that the percentage had, with the advance in studies, increased 21 per cent., making a total of 45 per cent. for Amhurst College, and 50 per cent. for Harvard College. Quite recently Dr. Dowling has published a valuable article dealing with an investigation made by him into the condition of the school children in Cincinnati, and he found that 17 per cent. of all the scholars were affected. Among children under nine he observed only 2 per cent. of myopia, and 38 per cent. of hypermetropia.

This part of the subject has been dealt with somewhat fully, because, to fairly understand the importance of the matter, it is essential to grasp something of what has been done to show the relation that close work, especially in young children during the years of school life, has upon the production of short sight, or its increase when

already present. The evidence set forth demonstrates that near-sightedness is induced during the whole period of school life, and that, from the observations made in all parts, it is correct to say, as Cohn does, that in the whole civilised world, the number of short-sighted scholars increases with the requirements of the school and the rank of the class.

We can now pass on to consider the influences which act injuriously on the eyesight of school children, and to discuss the means by which these conditions should be combatted.

LIGHTING OF SCHOOLS.

Good light is of prime importance. An evil which it is necessary to avoid, is the too close approximation of the scholar to his book ; and an indifferent, or bad light, necessitates a nearer approach to the writing or reading. But, while there should be good light, and plenty of light, it is of equal importance that the light should be *properly directed*. To have a room well lighted, as far as the degree of illumination goes, will be of little avail if the scholar is placed so that he reaps no proper advantage from it, but is, on the contrary, so situated that the book on which he may be occupied is thrown into the shade and a shadow cast on the part he is reading. Lighting from the roof would be perhaps an ideal method, but,

as this would necessitate one-storey buildings, it would be well nigh impossible in towns.

The surroundings of a school often interfere with its proper lighting, in spite of the best constructed and the most correctly placed windows. Cohn showed that the narrower the street in which the school-room was situated, the higher the opposite houses, and the lower the storey in which the lessons were given, the more numerous were the cases of myopia among the elementary classes. A French law requires the top of the window to be at a distance from the floor equal to two thirds the breadth of the room, and a French Commission also recommended that from each desk in the school-room there should be visible a strip of sky at least thirty centimetres in vertical extent, measured from the top of the window.

Light from the left is to be preferred, and the best position for a child, or any adult, is so that the light falls from the left, above, and somewhat behind. That from the right is objected to, as, owing to the position of the right arm on the desk, the point to which the gaze is directed is thrown into the shade, and this is the place where a good light is requisite. Light from behind is insufficient unless there is good side lighting. From the front it will be dazzling to those in the front row, and insufficient to those further back.



FIG. 4.
Group of children at work ; correct illumination from the left. (*Vide* page 21.)

The question of lighting from right or left is often only a matter of arranging the seats for the children, and a teacher who is aware of the importance of these matters will soon get them set right. When preparing this volume I visited a Board School, the girls' side of which was presided over by a most intelligent mistress, who was thoroughly alive to the necessity of good and properly directed light. She told me that when she became mistress the whole of the seats were wrongly placed, but that all that was necessary was a re-arrangement to bring them into a proper position. The photograph (*Fig. 4*, in preceding page) shows these children at their writing lesson with the light falling from the left, whilst another (*Fig. 5*, page 23) illustrates the light coming from the right, or faulty direction, and the children's copy books thereby thrown into the shade. There were no children in this school wrongly placed, and therefore the desks with the children as shown in the last mentioned photograph were turned so as to illustrate the point. At the same time lighting from the right is preferable to insufficient light. As little space as possible should be occupied by divisions in the windows, and, of course, the old manner of making the windows of small panes or ecclesiastical glass is to be condemned. The arrangement of the glass in the same way as a photographer has his win-

dows constructed, has been suggested as suitable for schools.

Rooms devoted to study should be flooded with light in such a manner that the darkest place occupied by any scholar may have sufficient light even on a dull day. It has been proposed to estimate the amount of light by photometers. There are, however, more practical and easily applied methods. It has been suggested (Strasburg Medical Report) that small diamond type should be able to be read at 12 inches distance,

The wise man observes, that there is a time to speak, and a time to keep silence. One meets with people in the world, who seem never to have made the last of these observations. (Bishop Butler.)

even by scholars furthest away from the windows. Again, in some schools on the Continent scholars have ceased to work when darkness was sufficient to prevent the reading of Snellen's 20 type at 20 feet.* The L printed here is of the size indicated.

L

All study that can be done by children in daylight should be accomplished then, and not put off till day has gone. No artificial lighting can make up for daylight. When required, artificial light should be ample and steady, and should come from a suitable direction. An unsteady light is dazzling and fatiguing. Nor

* *Vide* also Cohn's Type, page 67.



FIG. 5.

Faulty illumination; light falling from the right and throwing a shadow on the copy book. (*Vide* page 21.)

should the illuminant be placed too near the eye, because the heat emitted is injurious and occasions discomfort. The electric light is likely to give us the best method of illumination for schools. It has been employed on the Continent, and is now made use of in some schools in England. Fuchs tells us that in Liège the rooms used for drawing classes were lighted by it—these were evening classes—and the light was, by an arrangement of concave mirrors, thrown up to the ceiling, and thus diffused equally through the room, and the source of light was hidden. The light fell in equal degrees upon all the desks, was sufficient, and not dazzling.

The electric light has a further advantage in not vitiating the air as gas and other illuminants, and this in rooms used for long periods, with large classes, is a matter of considerable moment.

The subject of window blinds is of some importance, and Cohn has recently recorded some very interesting observations upon the materials suitable for use as blinds to windows in schools. Unsuitable stuffs will of course interfere improperly with the supply of light to the room, and dirty, unwashed blinds will be still worse, for, in addition to unduly keeping out light, they will act as germ catchers, and by being drawn up and down become what may be called germ distributors. Cohn mentions a school where the

blinds were not washed for eight years. A blind or curtain, he points out, (1,) should intercept the direct sun rays ; (2,) should not dazzle ; and (3,) should transmit a maximum of light. The effect should be like that of sky veiled with bright clouds. He does not find anything that perfectly fulfils these conditions, but, after carefully testing with Weber's photometer eighteen different textile materials, he classes four of these as good (two of the four being fine threaded white shirting, and strong threaded white Dowlas, and the others, apparently, of thin threaded twill), two as middling (these are both thick linen striped), six as bad (one of these is a thick cotton satin), and six as miserable (one of these is a bright yellow impregnated sail-cloth). Only the "good" materials should be used in school-rooms. Glass dulled on one side by sand blowing, and grey uncoloured cathedral glass transmitted more light than any of the textile materials. But the glass is costly and it is fragile, and, moreover, it is somewhat dazzling and cannot conveniently be put out of the way when not required.

DESKS, AND SEATING OF SCHOLARS.

The question of the posture and proper seating of the children in school is a very important one. A much more enlightened view is now entertained on this subject than was the case not long ago,



FIG. 6.

To illustrate distortion of Spine from faulty posture.
(*Vide* page 29.)

and its importance is becoming recognised. As evidence of this may be mentioned that whereas at the Paris Exhibition in 1867 there were only three school desks shown, at the last Exhibition no less than seventy-one were exhibited. A bad posture is not only injurious to eyesight, as will presently be demonstrated, but it is a fruitful source of crooked spine. Eulenburg says that 90 per cent. of curvatures of spine, not induced by local disease, are developed during school life, and in a school at Neuchatel among 381 girls, 156 were found to have more or less deviation of the spinal column. The manner in which the spine becomes distorted is illustrated in the photograph (*Fig. 6*), of two boys who sat purposely in a bad position writing at a table too high for them. To make the point which I desire to be illustrated more distinct, the line of the spine was inked.

The backless bench has long since been condemned for children of all ages and conditions. It is, however, hardly yet grasped that desks of different sizes are requisite according to the size of the children. It has well been observed (Snellen) "that it is absolutely impossible that a tall and short boy will both sit equally well on the same seat and at the same desk. It is just as unlikely as that the same clothes would fit the same pupils. Yet in many schools we find desks and seats the same size for all."

As a general rule, children in a school have the same desks quite irrespective of their size. It has been pointed out that the objects we have in view are to prevent undue approximation of the scholar to his lesson book and to avoid stooping. To attain these ends certain principles must be followed in the construction of desks. A back rest is important, because without it a child will not for long sit upright. It need not reach above the loins or lower part of the back—if it reaches to the upper part it will interfere with the free movements of the body. Also, unless a child is able to rest his feet on a foot-board or on the floor, and has to let his legs dangle, fatigue will result. The height of the seat, the height of the desk, and its slope, are all matters which should be observed, and indeed are attended to in all modern school desks. The slope for writing should be 20° and for reading 40° .

The best constructed desk with which I am acquainted, is one devised by Mr. Priestley Smith, and manufactured by the Midland Educational Company. It is made upon the principles advocated by Cohn, and is made of different sizes to suit the varying stature of the scholars. It would, in my opinion, be improved by being made somewhat lighter. I have ordered many of these desks for patients, with satisfactory results. In the photographs (*Figs. 7 and 8*) are depicted a little boy and



FIG. 7.



FIG. 8.

Writing and reading at properly constructed desks adapted to the size of children. (*Vide* page 30.)

girl sitting at these desks; the one writing and the other reading. The boy's feet, it will be observed, rest on the floor; the girl's do not, as the desk at hand when the photograph was taken, was a trifle large for her.

The two photographs (*Figs. 10 and 11*, page 35) may be contrasted with those just referred to. A boy is seated on a bench without a back, and is leaning over a table which is too high for him, and the faulty position assumed is inevitable under such circumstances.

This matter of seating of children is one of the most important if we are to prevent short sight or crooked backs. A medical report at Strasburg on an investigation into the influences of school life, speaks strongly as follows: "We look upon the doing away of the old school desks as the most urgent necessity of school hygiene. Every half year's delay causes fresh mischief."

Snellen has also expressed himself forcibly upon this subject: "The increase of myopia is a question which has greatly occupied the attention of oculists. We have sought for the cause of its development during the period of youth in the arrangement of schools. It has been said that the increase of myopia is a proof of the amount of mental development and school life of a nation. It would be nearer the truth to say that myopia is a proof of want of

care in the construction of schools. As a principal fault we regard the bad posture of pupils. Oculists admit that the constant stooping forward of the head is the most effective factor in the increase of myopia. The question of the improvement of the posture of the scholars involves in the first place the question of seats."

In order to keep the head of the scholar at a sufficient distance from the desk on which writing is being done, or on which the book being read is placed, a plan is sometimes adopted of using what are called straight holders. Kallman's Face Rest was employed a good deal

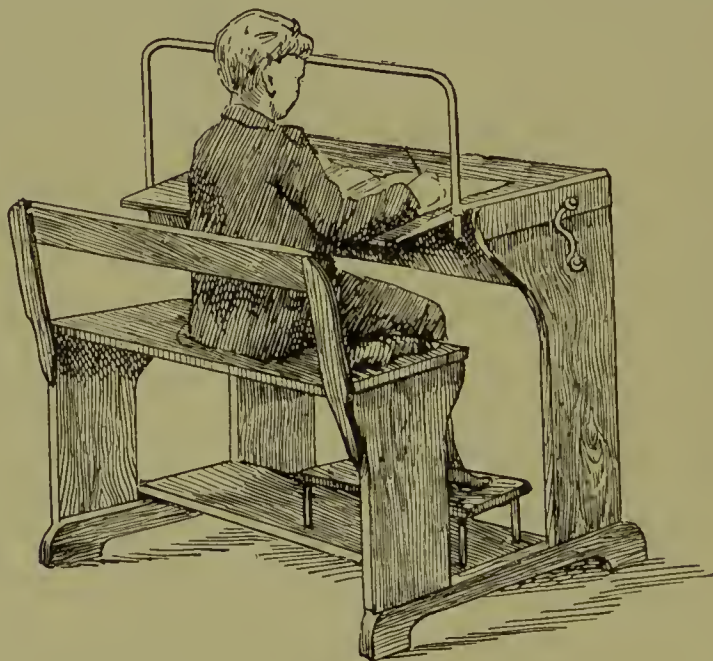


FIG. 9.

on the Continent. It was screwed to the table, and the iron ring against which the face rested



FIG. 10.



FIG. 11.

Improper posture caused by unsuitable bench and table. (*Wid* page 33.)

was enclosed in india rubber. Cohn in his recent work says that better than Kallman's is Durr's Horizontal Reading Support (*Fig. 9*). It is a horizontal bar of iron coated with india rubber and fastened by horizontal supports to the desk. It allows more freedom for the child. Cohn prefers this to all others.

READING AND WRITING.

These are two subjects that demand careful attention.

READING.—School books are much better printed now than was formerly the case. Some of those in use are excellent both as to size and style of type. The worst are the arithmetic or mathematical ones, when in reality, from the figures which crowd the pages, they should be the most clearly printed of any.

It is important that little children should have books with large, well printed letters which will be readily made out. Much of our reading is in reality guess work, and rapidity in forming our ideas has come to us by practice. Javal some years ago, in some interesting observations on the physiology of reading, pointed out that the eye in reading had no time to examine each letter in all its parts. The point of fixation in reality runs along a strictly horizontal line, cutting the letters below their tops. The other parts of the letters

are seen by a part of the retina at a greater or less distance from the centre. He explains this by saying that the eye runs horizontally to avoid unnecessary and tedious movements, and the line is determined by the form of the printed letters. If we cover the upper half of a line it will require considerably more effort to decipher it than if the lower half is covered. In the latter case it can be read just as easily as if the whole of the letters were seen. The example inserted here will show this.

To test this the reader will see that this sentence will be much more easily read the lower half being wanting than this where the upper half has been removed. And special words are not chosen, nor is special type selected (Joy Jeffries).

Javal proceeded to show from this that most of the letters projected above the line, but that as some of them presented similarities there was room for alterations in them which would facilitate reading.

Printing which is ill defined has to be brought nearer the eye, and hence, for the reasons before given, it is objectionable. All books should be printed in clear and well defined type. Cohn lays it down that type, taking "n" as the character, which is shorter than 1.5mm. is injurious. The

Pica which forms almost the standard of English is larger than this.

Reference is often made to school books, but, as far as I remember, little is said about the printing of music, and yet it is about their music that many little patients come to grief. Mr. W. H. Cummings only last year, in a most valuable paper read at the Annual Conference of the Incorporated Society of Musicians on "Music Printing, Ancient and Modern," made some observations very relevant to this matter. It will be well to quote his remarks: "If we are teachers it is no uncommon thing for us to have to read music with our pupils six, seven, eight, and aye, even nine hours a day. It is here the question of sight reading comes in, and with it the very serious inquiry—If we continue the strain which is imposed on the eyes of the present generation, what will be the result with the children of the next generation? I appeal to pianists. Do you think it fair or wise to permit yourselves or your pupils to play from small octavo editions of Beethoven or other writers? You know as well as I do that, given a good-sized, bold, legible copy you are not likely to play half as many wrong notes as you would do when reading from a miniature edition; you would not mistake a \sharp for a \flat nor would you have to strain your eyes to distinguish the ledger lines above and below the

staff. Then the organists. What have you to say to the octavo copies? If you are seated at a three manual organ, pushed up into a corner of the church with a very dim religious light, your music desk several feet away from your eyes, do you not sometimes, when you make a trip or play a wrong note, think of the printer, and, like the ancient mariner, bless him unawares? For the teachers of singing who, like myself, have to sit hour after hour and accompany at the pianoforte, I can only say we have to endure torture. Small printed oratorios, small printed operas, frequently with words in two languages, present difficulties which none but those who have to use them in the way indicated can by any possibility imagine. Then how bad it is for the singing pupil, who in order to get a blurred vision or a half view of the music has to stoop or put the head on one side, and so sings under the most disadvantageous circumstances, indeed in a manner admirably adapted to become an indifferent vocalist; and this terrible sacrifice is made on the score of imaginary cheapness." Mr. Cummings thinks the introduction of these small volumes has been an unmitigated evil, and he urged on his hearers to discourage the use of these small printed scores and to encourage those in which the notes are of fair size and thickness, and the words are printed in a bold-faced type.

The opinions here expressed have been given at some length because of their importance, and it is to be hoped that coming from such a prominent member of the musical profession their full force will be apparent to teachers as well as to those to whom they were addressed.

WRITING.—The methods employed in writing require careful notice. The old grey slate is in less request than it formerly was, and its place has in great measure been taken by pen and paper. The slate may well be spoken against, for the contrast between it and the pencil markings were at the best but slight, and when it became greasy they were rendered less so. The contrast of black letters on a white surface is much greater. It has been proved that letters written on a slate, to be equally legible, must be placed nearer to the eye than characters of the same size with pen and ink on ordinary white paper, the difference being as much as three to four. The late Professor Horner, of Zurich, was of opinion that the welfare of the eye demanded the expulsion of slates from schools. The use of ink and paper was advised and practically tested, and as the result the School Board adopted a resolution that pen and ink should be employed as writing material, but that the teacher should be permitted the use of slates for beginners in the first winter term. Cohn adopted these conclusions, and to obviate the

evils complained of in the old slate he had white composition slates made. They had a non-shining surface, and pencil markings were easily erased. I had a supply of these slates soon after they were first made, but as far as my knowledge goes they never came at all into use in this country; for one thing the cost was held to be prohibitive.

In many schools there is a tendency to give too much writing. All is eye work, and notes from lectures are taken down by girls until the number of note books and exercise books which they have in use is frequently very large.

A good deal has during the last few years been written as to the position pupils should occupy when writing, and whether the writing should be vertical or slanting. The latter held sway for long, but there is evidence that to some extent it is being superseded by upright penmanship, and will in the future be more so. For my part I am satisfied that for the objects one has in view for obviating sight failure, the upright is to be preferred to the slanting method. Some interesting evidence as to the opinion of teachers on this point has recently come before me. The head master of a Board School in answer to an inquiry from me as to what he thought of the upright manner of writing, and the influence it had upon the posture of the scholars, replied that for long he had been convinced that it was well nigh



FIG. 12.

Scholars engaged in vertical writing. Front view. (*Vide* page 45.)

impossible to get with the slanting method a natural pose of the body unless the paper were twisted, and then the lines of writing had to be looked at obliquely, and that he had therefore abandoned it, and for the last eighteen months he had employed in his school the Civil Service style, which, he said, was as near upright as possible without being so, and was free from all kinds of elaborate turnings and twists. The results were most gratifying. He said, "I have no hesitation in saying that I have now far less trouble to get an upright position of body, and that the habit of turning the head on one side and looking at the writing obliquely has practically ceased." Another instance came about in this way. I enquired of an assistant elementary teacher if upright writing was used in her school, and she answered that since a new head mistress had been appointed, a couple of years before, it had been introduced, and the altered position of the girls at their writing was most distinct and satisfactory. I visited this school and found a teacher alive to all the necessary hygienic requirements. I saw some of the girls writing, and their position was so excellent that permission was asked and obtained to photograph them. The illustrations from these photographs show (*Fig. 12*, page 44) the children taken from in front; another (*Fig. 13*, page 47) is from another class

viewed from behind. As to this last picture it must be remarked that the children did not, as may be supposed, wear "tailor made" dresses, and therefore as to some of the girls' backs, allowance must be made for badly fitting clothes. A preceding photograph (*Fig. 4*, page 20) is a side view and shows a room full of children in erect postures, and their books well illuminated by light falling from a proper direction. It may be mentioned that this teacher was well aware of the importance of properly directed light, and in all the class-rooms, of which three are illustrated in the photographs, did the light fall correctly. If all the schools, Board or Private, were so well looked after in these respects as was that just noticed, less would have to be written on School Hygiene and the Eyesight question.

From an oculist's point of view there are distinct advantages in the vertical method of writing. The eyes are directed straight to the copy, whilst in the sloping method there was a great tendency for a pupil to assume a slanting look with his eyes; this is represented in the photographs (*Figs. 10 and 11*, p. 35). Stooping also will be less liable to occur, and it will be easier for the scholar to keep at a proper distance from the book. The whole subject of upright writing has been very fully dealt with by Mr. Jackson, and his recently published work on the *Theory of Handwriting*



FIG. 13.

Scholars engaged in vertical writing. Back view. (*Vide* page 45.)

contains much that is most interesting and valuable. He has two capital illustrations—a front and back view—of the postures assumed in the slanting and vertical methods of writing. By his kind permission I am enabled to insert them (*Figs. 14 and 15, pages 51 and 53*). They will be seen to show well the two points just before alluded to, viz., that the eyes are directed straight to the book, and that the method minimises stooping. This author quotes at length a lecture delivered by Schubert at Nuremburg on perpendicular writing in schools. It contains most interesting information on the subject. The following quotation as to the position with this method and with the slanting plan is all our space will allow of giving: “In the beginning the children all sit straight. To the specialist even at the outset the straight posture of the vertical writing children is remarkable; the others lose this fine erect posture at the first stroke which they make obliquely. After the lapse of three minutes the sloping writers will fall together (collapse). After ten minutes they assume the most peculiar posture; after a quarter of an hour their heads are scarcely 12 to 14 c.m. distant. The vertically writing children remain sitting straight during the whole writing lesson and in as good a posture as at the beginning. Usually after four or five minutes the stranger can distinguish all those who

write vertically from behind without having seen the writing." Schubert also quotes a lady teacher as saying, "All the children who were introduced to vertical writing afforded in respect to faultless sitting and caligraphy thoroughly satisfactory and even surprising results."

Schubert, moreover, supported his opinion as to the injuriousness of slanting writing by the fact that of the two eyes, that of the right was most frequently the stronger in refraction (more myopic or less hypermetropic). In 915 children in Nuremburg he found 34 per cent. had stronger refraction in the right, and 18 per cent. in the left. He made a table of results of examination of 21,949 children by different investigations and it was found that 3,263 had stronger right refraction and 2,032 had stronger left refraction, or, in those who were anisometropic, 62 per cent. were higher in right, and 38 in left.

Cohn also in his recent work (*Lehrbuch des Hygiene des Auges*) says :—

· "I abide by the opinion I expressed ten years ago—'undoubtedly vertical writing is the writing of the future.' No one speaking from the physician's point of view has declared himself against this writing. Even if oblique writing with an oblique central position of the copy book be supposed uninjurious, yet, for the teacher to make sure that every scholar has his copy book at the



FIG. 14.

Position in sloping writing (Jackson).

Front view.

Position in vertical writing (Jackson).

Front view.

(*Vide* page 49.)

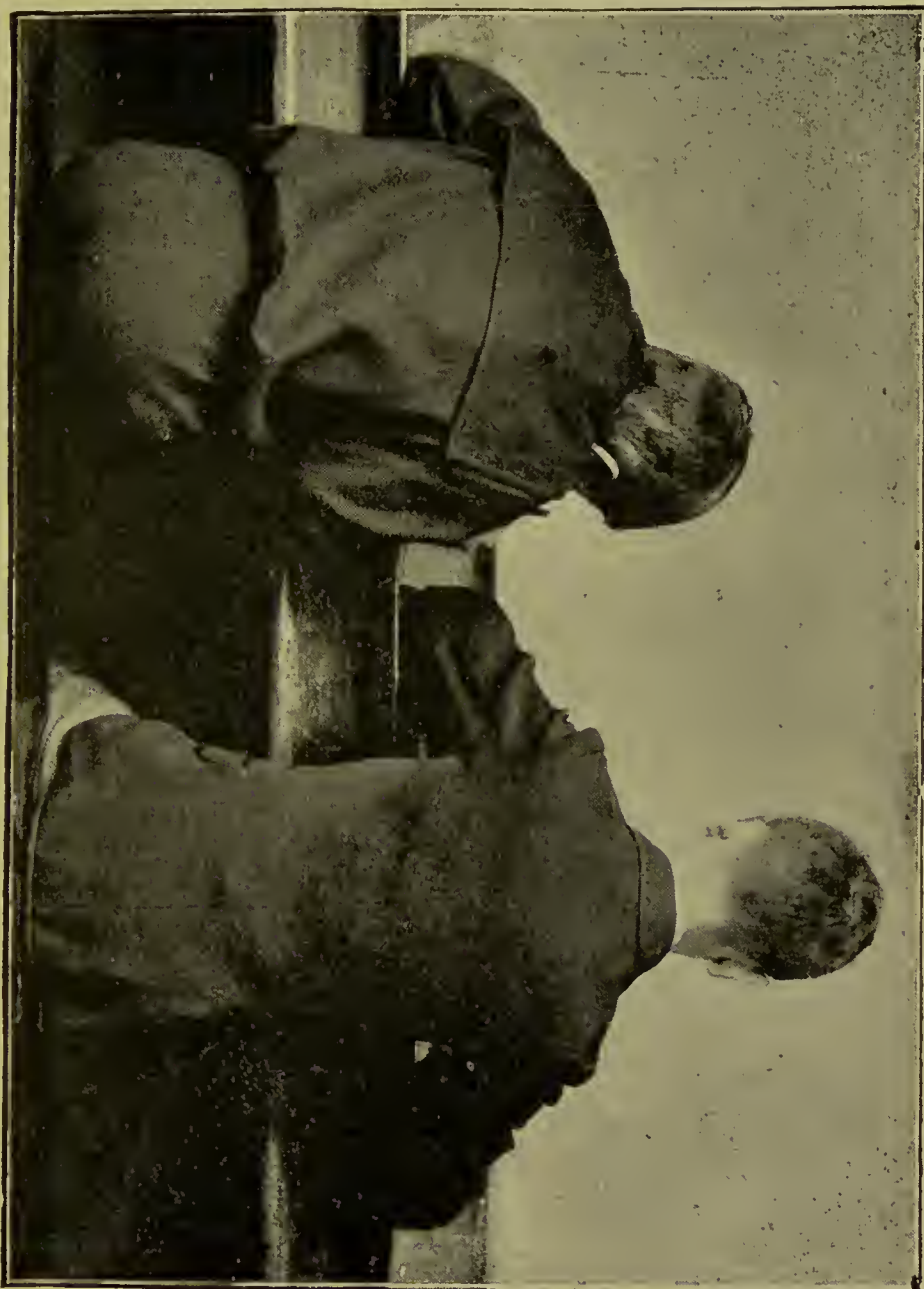


FIG. 15.

Twisted position required and taught in sloping writing (Jackson). Back view.

Natural position required and taught in vertical writing (Jackson). Back view.

(*Vide* page 49.)

proper angle (30° — 40°) is difficult, and in the case of home work quite impossible, but if the child has written out his exercises vertically that is a proof that he has been sitting correctly whilst doing so, for it is only whilst sitting correctly that vertical writing can be executed with ease."

HOURS OF STUDY.

The prejudicial influences already mentioned will act with greater force if associated with bodily fatigue and over-work, especially brain work, and it is said with truth that children's heads cannot stand the long hours of study often required of them, and that over-work during the period of nervous development is especially hurtful. To this it may be added that neither can eyes with impunity bear the long-continued strain to which they have so frequently to submit. For in addition to the effort of brain to fix the images on the memory, implanted there through the perceptive elements in the retina and optic nerve, are the muscular actions previously described, of focusing and converging. The more weary the scholar becomes, the closer to the eye will go the book. The intervals of rest in the hours of study, even if short, should be frequent. There is also much to be said for the older plan of morning and afternoon school, rather than a long time all at a stretch. The former allowed time between

school hours for recreation, and what is of the utmost consequence to children, a good substantial mid-day meal. A lady of whom enquiry was made, said she had gone back to the divided hours, and that the pupils and teachers ate twice as much since the return to the old plan as they did under the other system.

It is, however, not merely the time spent in schools but the extra hours occupied at home in preparation that we have to bear in mind. This home work, if it cannot always be abolished, requires careful management. For young children it should certainly be dispensed with. The subject has been discussed by teachers as well as by medical men, and one of the best known head mistresses a few years ago said, "We have to a great extent escaped from over pressure by a careful construction of home time tables." The writer has not a very firm belief in the rigid following of tables away from the restraint of school. The objection we have here to urge is, however, that study, reading, and writing, will be accomplished in the majority of cases without the slightest regard to the hygienic conditions which have been insisted upon as being so necessary. It is certainly as desirable that the child's attitude at home should be as correct as at school, and especially that the regulations as to light should be carried out, and more so because for the greater part

of the year artificial illumination will be required. In many cases attention to these matters at home will be impossible, and this is a reason for the preparation classes being held at the school. To those who can afford it a suitable desk should be provided, or the cheaper slope which can be placed on any table will answer the purpose.

Some interesting statistics on this question of home work have been published. Dr. O. Just, wishing to ascertain the effects of new sanitary measures introduced for the prevention of short sight, examined 1229 pupils of the two High schools at Zittau. The hygienic arrangements in both as to light and space left nothing to be desired. The contrast between them and the dark rooms of older schools was, he says, most striking. He arrived at the following conclusions :—

“Myopia being as prevalent in the schools of Zittau as in other educational institutions of the same kind, we may fairly conclude it does not result from insufficient illumination of the school rooms, but rather from the great and ever increasing demands on the industry of the pupils at home, forcing prolonged labour on their eyes during evening hours, frequently by insufficient artificial light.” To this he adds, “I am far from under-rating the dangers of bad sanitary conditions in the school-rooms, but would urge the

necessity to disencumber our children's eyes of as much evening work as possible."

NEEDLE WORK.

Fancy needle-work and fine embroidery are in many instances to be discountenanced. It is necessary and useful for every girl to be taught the use of her needle, but the amount of fine needlework which was, and it is presumed is still, required at schools, is to be deprecated.

Samples of the various kinds of needle-work required of the different standards in elementary schools were some time since brought to me by a teacher, and they appeared to me unnecessarily and injuriously to tax the pupils' visual capacities.

PHYSICAL EXERCISE.

A recognition of the need of physical exercise for our boys and girls is re-asserting itself. There has been and is much danger of the body being neglected for the mind, but it may with confidence be asserted that in the battle of life and the struggle for existence, a good physique is of no less importance than a cultured mind. It is pleasing to note that Fuchs writing on this subject instances with approval the practice of our schools as to games. He says, "The model for all is the education of youth as practised in England, in which what are called 'Athletics' play a great

part. To these belong swimming, rowing, riding, archery, and a great number of games which are played in the open air and demand bodily agility."

It is important to bear in mind respecting manual, or what we may call recreative, work that children much occupied otherwise in close eye work, should not during these exercises have an addition made to it. Boys manage much better than girls; they will have their play, and they enter heartily into their cricket and football. But it is on the girls that the stress of the educational system appears mostly to tell, and they are the more liable, it seems to me, to suffer from eye strain and myopia, certainly in the middle classes and higher schools. It will be well to encourage those occupations or amusements that tend rather to cultivate the distant vision, as tennis, rambles in the country observing nature, both being recreative and educative. The late Mr. Thring was right in making much of the educational value of awakening the attention "to the beauty of God's thoughts in creation; the voices that speak in cloud and rain, in river, forest, mountain, plain, flower and grass. For all we see is thought made visible. Again, take the great ear languages which appeal to the feelings—music; the song of birds; the voice of winds that breathe o'er land and sea in tenderness or wrath; the water shouting in joy, chanting low rippling songs, roaring in their furious onset. And, last of all, word-

language, which partakes of the power of all, and is the most living exponent of life—word-language which bears in its bosom the sacred gift of conversing with the great minds and glorious thinkers of all time.”

THE DUTIES OF PARENTS AND TEACHERS.

PARENTS.—The home life of the pupils plays without doubt a by no means unimportant part in the causation of the ills of the school period. Especially is this the case with the elementary school children, many of whom must almost of necessity be badly fed and housed. But besides this my experience is that parents are too apt to shirk their own responsibilities and throw them on the teachers. To the doctor they may murmur at the over-pressure and over-work at school, but here it seems that their duty ends. The following instance may be taken as a specimen of many, but we may regret it was a doctor's daughter. A head mistress, in the *Journal of Education* some little time since, said, “For instance, I know of a pupil, a doctor's daughter too, in a school where an honest attempt was made not to over-work the elder girls, who habitually for two years worked seven or eight hours a day *out* of school, and frequently left home without breakfast, and no one ever found it out at the time, but one mistress was firmly persuaded she was an idle girl because

her subject happened to be an uncongenial one, and no amount of preparation given to it produced satisfactory results."

If it is necessary that precautions should be taken during school hours, it is equally desirable that they should not be neglected outside. It is incumbent on every parent sending a child to school with defective eyesight to mention the fact to the teacher. It is desirable, moreover, that they see that their children when engaged on home lessons or in other reading or writing, assume a proper position in a good light; that they also bear in mind what has previously been written in these pages and that also which follows in the next section.

TEACHERS.—Teachers have it in their power to render very material assistance in preventing deterioration of vision in their scholars.

The points already mentioned as to the lighting of schools, the school desks, and the posture of the children, when engaged in writing and reading, should be borne in mind by them. When a child with defective sight is sent to school, the teacher should be made acquainted with the fact by the parents, and especial pains should be taken with that child. It should not, however, be difficult for a teacher to recognise a real defect, and not mistake for stupidity or idleness that which is the result of genuine inability. Still, teachers are frequently

doing this, and many unhappy children have punishments inflicted on them simply and solely for mistakes arising from want of visual power. It is not easy to excuse such conduct as this, and parents are more than justified in feeling and speaking strongly on it. A child who is known to be short sighted should be placed towards the front, where the task of seeing what is written on the black-board will be easier. A teacher also who has observed a pupil's sight to be defective should communicate the fact to the parent of the scholar, so that proper advice may be obtained. Especial attention should be paid to such children at their lessons. They should sit upright; avoid stooping; avoid close work, less than 12 inches is hurtful; work should be done in a good light from a proper direction; writing should be curtailed; frequent pauses between the lessons enforced and home work abolished or regulated. Teaching through the ears to save the eyes when practicable in aggravated cases should be employed. Types to aid a teacher in detecting short sight have been prepared,* and the Anthropometric Committee of the British Association has printed a series of suggestions for use in schools. They deal with hearing, bodily condition, such as height, weight, etc.; but what interests us here is that directions are given as to sight. These were

* Snellen's Test Types are given at the end.

drawn up for the Committee by Mr. Priestley Smith, and if acted upon by teachers without doubt much good would result. A friend of mine, a head-master of an important school, some years ago, before the "Suggestions" to be now mentioned were issued, went into the subject, making his own observations as to his scholars' vision, and was of opinion that much good would accrue from a systematic examination.

DIRECTIONS OF COMMITTEE.

TESTS OF VISION.—These tests will serve to detect the presence of certain common defects of vision. Such defects are often overlooked or disregarded, to the permanent detriment of the pupil. The tests will not reveal the nature or cause of a defect. This can only be determined by an expert.

(a,) ACUTENESS OF VISION.—(1), Hang on the wall, in a good light, a set of Snellen's Test Letters; these are in general use, and afford records which can be universally compared. *No others should be substituted for them.* (2,) Draw a line on the floor at a distance of exactly six metres from the letters, and let each pupil in turn toe this line and try to read the letters, line after line, beginning at the top; in all cases without spectacles or eye-glasses. Each eye is to be tested separately, the other eye being covered,

but not pressed upon, by a large card held in the pupil's hand. (3,) Record the vision of each eye separately in the form of a fraction, for instance, thus :—

$$\begin{array}{lcl} \text{R.} & V & = \frac{6}{6} \\ \text{L.} & V & = \frac{6}{18} \end{array}$$

The numerator is in all cases 6, *i.e.*, the distance of the letters in metres ; the denominator is the number which stands over the lowest line of letters which can be read. When the vision is less than $\frac{6}{60}$ it should be recorded by the appropriate sign, viz. :— $V < \frac{6}{60}$. (4,) Take care that the pupils have no opportunity of learning the letters by rote.

Note.—When the vision of either eye is found to be represented by a fraction having a denominator of more than 18, it will generally be desirable to report the fact to the parent or guardian, in order that proper advice may be obtained, such report being omitted if this has



already been done. The letter T represents the size of type referred to.

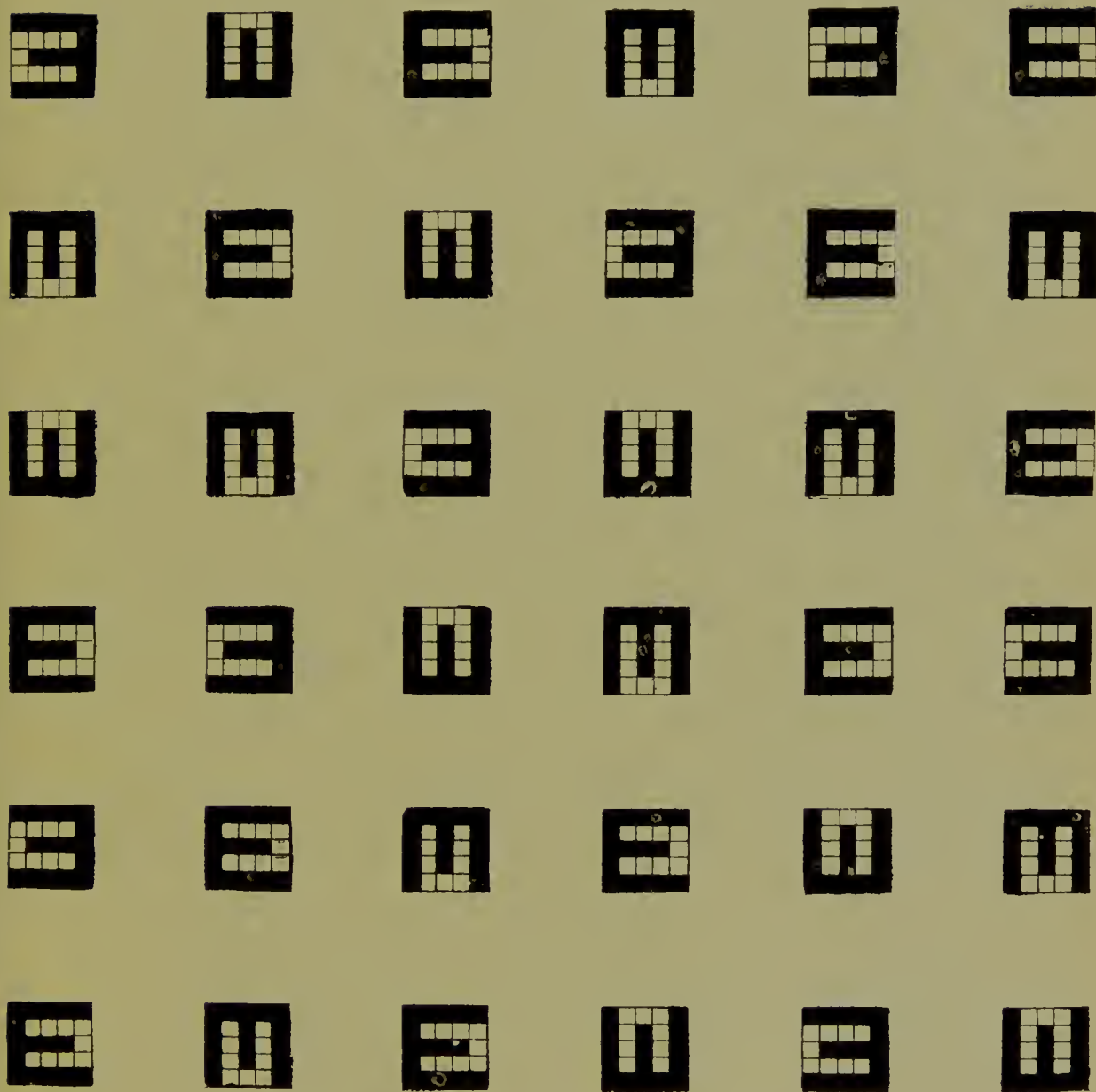
The value of these suggestions lies in the fact that a means of recognising defects is placed in the hands of the teacher. It is also one that is simple in use. Every child entering school should be tested and the condition of vision noted. The examination should be repeated every year. Cases of defect of sight should be reported to the parents, so that medical assistance could be sought, and appropriate glasses, if such were required, would then be ordered. A test as indicated would catch low degrees of myopia, and cases which at present tend to go from bad to worse through neglect would be detected. The advantage accruing from the wide-spread control would be great if the fullest means are to be adopted for the prevention of short sight.

It has been thought that children when tested might become familiar with the letters used as a test, and communicate to others about to be examined the characters which will be presented to them. There are many ways in which this may be avoided, but Cohn has devised a plan for testing, which perhaps makes learning by heart impossible.

Among Snellen's Types a set has for long been included for testing illiterates, consisting of E's of graduated sizes corresponding to the other types, but so arranged to the right or left, up or down, that a patient can be asked to state the direction

towards which the branches point, instead of naming the letters as an educated individual would do with the ordinary test types. Cohn has adopted this principle as a test for school children. The size of figure corresponds to that read by the normal eye at six metres, and the E's are arranged in a square, consisting of six rows of six each, making thus 36 E's. A hook is, moreover, attached to each of the four sides of the card, which admits with the manner in which the figures are arranged, of manifold variations in the test. The E's may be read either across from right to left, or the reverse, above downwards from either side, from below upwards, or any line may be selected for the scholar to read, etc.

The test is directed to be hung at six metres in a good light, attached by one of the hooks, on a level with the height of the pupil, and the child tested has to say straight off the direction towards which the branches point, to the right, left, up or down, as the case may be. Should the scholar be able to make out the E's at six metres, his vision $(V) = \frac{6}{6} = 1$. Should he be unable to do so, he is advanced nearer to the test, the distance noted and his vision recorded thus, if it be at four metres as $\frac{4}{6}$ or at two metres as $\frac{2}{6}$, as the case may be. Many of these defects in vision would be improved either by a convex or concave glass. Should, moreover, the type be illegible to one



COHN'S TEST TYPE.

possessing normal vision at six metres, it would indicate that the light was defective, and thus the same test can be employed as Cohn suggests as a light test if kept suspended in the school-room.

Dr. S. D. Risley of Philadelphia, claims that the thorough manner in which the ophthalmic surgeons of that city have for many years corrected refraction errors has led to very definite results. Altogether he deals with no less than 200,000 eyes. He took his cases from his private practice for twenty years, but thinking that error might arise from these clients being drawn from the more successful and studious portions of the community, and might present a higher percentage of myopia, he supplemented them by culling a further number from the prescription papers of two well-known opticians. He says if there was a causative relation between congenital anomalies of refraction and myopia, as his earlier observations led him to believe, then the correction of those defects should lead to a diminution in the percentage and degree of myopia.

A consideration of the evidence of the large number of eyes with which he dealt, "substantially demonstrated the essential responsibility of anomalies of refraction in the etiology of short sight, and also the value of treatment and correction of these eyes in arresting the increase of myopia."

He concludes that "the progress of the in-

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